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Atlantic Bluefin Tuna (*Thunnus thynnus*) Recovery Potential Assessment Science Peer Review

Processus de consultation scientifique - Évaluation du potentiel de rétablissement du thon rouge de l'Atlantique (*Thunnus thynnus*)

13-15 July 2011
St. Andrews Biological Station

Du 13 au 15 juillet 2011
Station biologique de St. Andrews

Meeting Chairpersons
Julie M. Porter and Lei E. Harris

Co-présidentes de la réunion
Julie M. Porter et Lei E. Harris

Biological Station / Station de biologie
Fisheries & Oceans Canada / Pêches et Océans Canada
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November 2011 / **Novembre 2011**

Canada

Foreword

The purpose of these Proceedings is to document the activities and key discussions of the meeting. The Proceedings include research recommendations, uncertainties, and the rationale for decisions made by the meeting. Proceedings also document when data, analyses or interpretations were reviewed and rejected on scientific grounds, including the reason(s) for rejection. As such, interpretations and opinions presented in this report individually may be factually incorrect or misleading, but are included to record as faithfully as possible what was considered at the meeting. No statements are to be taken as reflecting the conclusions of the meeting unless they are clearly identified as such. Moreover, further review may result in a change of conclusions where additional information was identified as relevant to the topics being considered, but not available in the timeframe of the meeting. In the rare case when there are formal dissenting views, these are also archived as Annexes to the Proceedings.

Avant-propos

Le présent compte rendu a pour but de documenter les principales activités et discussions qui ont eu lieu au cours de la réunion. Il contient des recommandations sur les recherches à effectuer, traite des incertitudes et expose les motifs ayant mené à la prise de décisions pendant la réunion. En outre, il fait état de données, d'analyses ou d'interprétations passées en revue et rejetées pour des raisons scientifiques, en donnant la raison du rejet. Bien que les interprétations et les opinions contenues dans le présent rapport puissent être inexactes ou propres à induire en erreur, elles sont quand même reproduites aussi fidèlement que possible afin de refléter les échanges tenus au cours de la réunion. Ainsi, aucune partie de ce rapport ne doit être considérée en tant que reflet des conclusions de la réunion, à moins d'indication précise en ce sens. De plus, un examen ultérieur de la question pourrait entraîner des changements aux conclusions, notamment si l'information supplémentaire pertinente, non disponible au moment de la réunion, est fournie par la suite. Finalement, dans les rares cas où des opinions divergentes sont exprimées officiellement, celles-ci sont également consignées dans les annexes du compte rendu.

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TABLE OF CONTENTS

SUMMARY

In May 2011, COSEWIC determined that Atlantic bluefin tuna in the western Atlantic was Endangered. The reason for the designation is that the current abundance of spawning individuals is the lowest observed and the abundance of spawning fish has declined by 69% over the past 2.7 generations. COSEWIC concluded that the cause of the decline, overfishing, has not ceased and that it is not clearly reversible. A Recovery Potential Assessment (RPA) was held 13-15 July 2011 at the St. Andrews Biological Station, St. Andrews, NB. Participants included DFO staff (Science, Fisheries Management, Species at Risk, and Policy & Economics), stakeholders, and external experts. The purpose of the RPA was to provide information and scientific advice required to meet various requirements of the *Species at Risk Act* (*SARA*), including public consultations, decisions regarding the listing of western Atlantic bluefin tuna in Canadian waters under the Act, and developing a recovery strategy should the species be legally listed. In Canadian waters there is no evidence that range has been reduced and the proposed distribution target for recovery is to maintain habitat conditions allowing for a broad distribution in Canadian waters. Spawning stock biomass (SSB) shows an initial steep and steady decline from 1970 to the mid-1980s and relative stability since then, with indications of a possible slight increase in recent years. The proposed recovery target for abundance is to increase spawning stock biomass compared to 2012; 2025 SSB would be equal to or larger than the 2012 SSB for catches of 2,250 mt or less. Maximum allowable harm was agreed to be the maximum removals by the fishery that would still result in the SSB in 2025 being greater than the SSB in 2012. The only documented human induced mortality to Atlantic bluefin tuna in Canadian waters is fishing; feasible mitigation measures to minimize the threat posed include a reduction or elimination of landings of western Atlantic bluefin tuna in directed fisheries or as a bycatch in other fisheries, and measures to increase the post-release survival of any Atlantic bluefin tuna released.

There will be a Science Advisory Report and one Research Document resulting from this meeting in addition to the Proceedings.

SOMMAIRE

En mai 2011, le COSEPAC a déterminé que le thon rouge de l'Atlantique Ouest est en voie de disparition, étant donné que l'abondance des reproducteurs au sein de ce stock est actuellement au plus bas de ses niveaux observés à ce jour et qu'elle a diminué de 69 % au cours des 2,7 dernières générations. Le COSEPAC a conclu que la cause du déclin, la surpêche, n'a pas disparu et qu'il n'apparait pas clairement que la situation puisse être renversée. Une évaluation du potentiel de rétablissement (EPR) a eu lieu du 13 au 15 juillet 2011 à la Station biologique de St. Andrews, située à St. Andrews, au N.-B., à laquelle ont participé des employés du MPO (Sciences, Gestion des pêches, Espèces en péril, et Politiques et Économique), des intervenants et des experts externes. Le but de l'EPR était de réunir les renseignements et formuler l'avis scientifique nécessaires pour satisfaire aux diverses exigences de la *Loi sur les espèces en péril* (LEP), concernant notamment les consultations publiques, les décisions sur l'inscription éventuelle du thon rouge de l'Atlantique Ouest des eaux canadiennes sur la liste d'espèces de la LEP et la conception d'un programme de rétablissement de l'espèce si elle venait à être inscrite sur cette liste. Comme rien n'indique que l'aire de répartition du thon rouge ait diminué dans les eaux canadiennes, l'objectif de répartition proposé pour le rétablissement consiste à maintenir des conditions d'habitat propices à une vaste répartition dans ces eaux. La biomasse du stock de reproducteurs (BSR) a connu un déclin net et constant de 1970 au milieu des années 1980, puis une stabilité relative; selon certaines indications, elle pourrait avoir augmenté légèrement ces dernières années. L'objectif d'abondance proposé pour le rétablissement consiste à accroître la BSR par rapport à son niveau de 2012. La BSR 2025 serait égale ou supérieure à la BSR 2012 pour un total autorisé de captures (TAC) égal ou inférieur à 2 250 tm. Il a été convenu que les dommages admissibles maximaux correspondraient au niveau maximal de retraits de la pêche qui permettrait que la BSR de 2005 reste supérieure à la BSR de 2012. La pêche est la seule source documentée de mortalité d'origine anthropique du thon rouge de l'Atlantique Ouest dans les eaux canadiennes. Les mesures qu'il est possible de prendre pour atténuer les menaces peuvent comprendre la réduction ou l'élimination des débarquements de thon rouge de l'Atlantique Ouest provenant soit de la pêche dirigée, soit de captures accessoires dans le cadre d'autres pêches, ainsi que la mise en place de moyens pour accroître la survie après remise à l'eau de tout thon rouge de l'Atlantique capturé.

En plus du compte rendu, un avis scientifique et un document de recherche résultant de cette réunion seront produits.

INTRODUCTION

The meeting was Co-Chaired by Dr. Julie M. Porter and Ms. Lei E. Harris (DFO Science, St. Andrews Biological Station).

The Co-Chairs welcomed the 41 participants on 13 July 2011, noting a broad suite of expertise and affiliation from both DFO and stakeholders. The meeting Agenda, Terms of Reference and List of Participants can be found in Appendices 1-3, respectively.

These Proceedings are meant to serve as a consensus summary of the meeting's principle discussions and conclusions and is not intended to be a chronological transcript. The Proceedings complements the Science Advisory Report (SAR) and the Research Document and is not intended to be used in isolation. The SAR captures the discussion and conclusions of the meeting; the Proceedings document expands somewhat on how those conclusions were reached and the major discussion points; the Research Document provides sufficient detail so the exercise could be repeated.

Two Working Papers were presented (and available to participants 1 week in advance of the meeting):

- Lester, B. 2011. Bluefin Tuna in Atlantic Canadian Waters: Scenarios for Mitigation and Alternatives to Activities. CSA Working Paper 2011/29.
- Maguire, J.-J. 2011. Bluefin Tuna (*Thunnus thynnus*) Recovery Potential Assessment. CSA Working Paper 2011/30.

When the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designates an aquatic species as Threatened or Endangered, Fisheries and Oceans Canada (DFO), as the responsible jurisdiction under the *Species at Risk Act* (*SARA*), is required to undertake a number of actions. Many of these actions require scientific information on the current status of the species, population or designable unit, threats to its survival and recovery, and the feasibility of its recovery. Formulation of this scientific advice has typically been developed through a Recovery Potential Assessment (RPA) that is conducted shortly after the COSEWIC assessment. This timing allows for the consideration of peer-reviewed scientific analyses into *SARA* processes including recovery planning.

In May 2011, Committee on the Status of Endangered Wildlife in Canada (COSEWIC) determined that Atlantic bluefin tuna (*Thunnus thynnus*) in Canadian waters was Endangered. The reason for the designation is that the current abundance of spawning individuals is the lowest observed and the abundance of spawning fish has declined by 69% over the past 2.7 generations (about 40 years). COSEWIC concluded that the cause of the decline, overfishing, has not ceased and that it is not clearly reversible.

To give context to the RPA process - scientific information (the RPA) is needed to support the development and assessment of social and economic cost and benefits of potential management scenarios for recovery to better inform public consultations and to support other entities involved in the decision of whether to add the species to Schedule 1 of the *Species at Risk Act* (*SARA*). If it is legally listed, the information in the RPA will be used to develop a recovery strategy.

It was emphasized by the Co-Chairs that in this particular RPA for Atlantic bluefin tuna in Canadian waters, no new analyses were provided or presented. Atlantic bluefin tuna is a very information-rich species, and for this RPA existing information from the International

Commission for the Conservation of Atlantic Tunas (ICCAT) and other published literature was packaged into the RPA format.

BLUEFIN TUNA ECOLOGY, HABITAT, STATUS, AND TRENDS IN ATLANTIC CANADIAN WATERS

Assess Species Status and Trends In Atlantic Canadian Waters

1. ***Evaluate present bluefin tuna status for abundance and range and number of populations.*** [1]

2. ***Evaluate recent species trajectory for abundance (i.e., numbers and biomass focusing on matures) and range and number of populations.***

It was generally concluded that there is only one population of Atlantic bluefin tuna in Atlantic Canadian waters and that these fish are from the western Atlantic stock. Biological sampling (otolith micro-chemistry) indicates that fish from the Gulf of Maine in USA waters are true to the western Atlantic spawning component; however, this type of analysis has yet to be done for fish captured in Canadian waters off southwestern Nova Scotia and in the southern Gulf of St. Lawrence. It was noted that western Atlantic bluefin migrate into the eastern Atlantic (*i.e.*, east of 45° W used to separate eastern and western Atlantic stocks) and mix with the eastern Atlantic stock. Also, Atlantic bluefin tuna originating from the eastern Atlantic stock have been captured in the mid-Atlantic Bight region off the eastern USA and represent a portion of the landings from this area. However, the population in Canadian waters is considered to be close to 100% western Atlantic stock, and mixing with the eastern stock would only come into play in the assessment of the entire western Atlantic stock.

Industry commented on the distribution maps presented at this meeting and indicated that these maps reflect where fishing effort occurs and not the full range of Atlantic bluefin in Atlantic Canadian waters. For example, southwestern Nova Scotia fishermen have been fishing closer to home and not making as many trips to areas like the Hell Hole since fish are readily captured closer to shore (*i.e.*, along the coast from Riverport to Yarmouth). Similarly, fishermen from Prince Edward Island now operate mainly in the southern Gulf of St. Lawrence where there is an abundance of fish and do not fish "ex-sector" in 4Wd and the Hell Hole.

These changes in the relative distribution of Atlantic bluefin within Canadian waters are likely associated with changes in prey distribution and oceanographic factors. Electronic tag data should be used to provide information on where fish are in Canadian waters (outside of the fishery distribution). These tags capture both the fishermens' knowledge of the distribution of Atlantic bluefin and possible bluefin tuna migration routes. Overall, it was concluded that the range of Atlantic bluefin tuna in Atlantic Canadian waters has not changed.

The most recent stock assessment of western Atlantic bluefin tuna was conducted by the (ICCAT) in 2010 (Anon. 2011a, b), and the next assessment is planned for 2012 (Anon. 2011a, b). The assessment methodology used has not changed very much over the past number of years, although some new methods are planned for the 2012 assessment. There has been both over-reporting and under-reporting of landings in the eastern Atlantic and Mediterranean Sea, but more recently under-reporting.

[1] Numbers in the third level headings refer to each Term of Reference in Appendix 2.

Spawning stock biomass (SSB) (Age 9+) and numbers for the western Atlantic stock have declined since the early 1970s to mid-1980s, and have remained stable and low since then. The recruitment at age 1 for the 2003 year class appears strong (~200,000), but subsequently, there have been no strong year classes and recruitment appears to be low but stable.

It was pointed out that some of the catch in the 1970s from the mid-Atlantic Bight area in USA waters may have originated from the eastern Atlantic, but there are very few data available to confirm the relative proportions of each stock in the catch back then. Assessment models which incorporate mixing between eastern (although data deficient) and western stocks indicate less of a decline in biomass compared to the base case model used for providing assessment advice. A sensitivity run conducted during the 2008 assessment (Anon. 2009) which used catch data and available tuning indices back to 1960 showed that biomass was low in the 1960s, increased in the early 1970s then declined in the 1980s. Again, this analysis was not adopted as a base case for stock assessment advice. However, it illustrates that the decline since 1970 could be interpreted as less severe if indeed the stock size prior to 1970 was lower.

The group felt that results from these sensitivity runs indicated different biomass trends from the Base VPA and that there is uncertainty associated with mixing that affects the abundance trends of western Atlantic bluefin tuna. It was concluded that the SAR should reflect this source of uncertainty.

Reference was made to the high catches of Atlantic bluefin tuna which occurred off Brazil from a Japanese longline fishery in the early 1960s. Very little is known about this fishery and the origin of the stock.

Canadian catch per unit effort (CPUE) indices for southwestern Nova Scotia and the southern Gulf of St. Lawrence both show an increase since the mid-2000s; this increase is believed to be related to availability. Catch rates are also improving in northeastern USA waters.

Although SSB at maximum sustainable yield (MSY) was estimated at 92,000 mt using the high recruitment scenario from the Beverton-Holt (B-H) stock recruitment (S-R) model, the assessment indicates that SSB has only ever been as high as about 50,000 mt.

3. ***Estimate, to the extent that information allows, the current or recent life-history parameters for Atlantic bluefin tuna (total mortality, natural mortality, fecundity, maturity, recruitment, etc.) or reasonable surrogates; and associated uncertainties for all parameters.***

The age at maturity for western Atlantic bluefin tuna is 9+ (compared to age 4 in Mediterranean); trends in F on age 9+ seem to have decreased and natural mortality rate (M) is currently assumed to be = 0.14.

The age at maturity (9+) used for the assessment of the western Atlantic stock has not been reviewed/updated for several years and may actually be lower now as compared to the past. Recent analyses based on new information from endocrine and gonad data suggest that the maturity ogive should be adjusted downwards, with maturity occurring at a younger age. This downward shift in maturity would be another source of uncertainty which could influence the interpretation of stock status and trends.

It was noted that changes in fecundity and age at maturity have been observed in some heavily fished stocks. The eastern Atlantic bluefin tuna stock is heavily exploited and exhibits a lower age at maturity.

At present it is assumed that there have been no changes in the growth of western Atlantic bluefin tuna or indications that the population is under stress. Growth of ages 1-3 is based on modal analysis while a general growth model is used for age 4-15+ based on data from 1980 to the early 2000s. No recent work has been conducted to determine if growth has changed relative to earlier time periods; the data used for this analysis needs to be updated.

Condition factor is another indicator of stress and showed a decline in the Gulf of Maine in the early 2000s but appears to be increasing again (Paul et al. 2011; Golet et al. 2007). The decline in condition appeared to be tracking changes in the condition of Atlantic herring (Golet et al. 2007).

1. ***Estimate expected population and distribution targets for recovery, according to DFO guidelines (DFO 2005).***

ICCAT does not consider Precautionary Approach Reference Points but uses B_{MSY} as a recovery target. However, because of the high (B-H model) and low recruitment (two-line model) scenarios there are two recovery targets for B_{MSY}. The Beverton-Holt model has a higher S-R trajectory compared to the two-line model and indicates that biomass has not rebuilt to former levels (*i.e.*, B_{2009}: 14,000 mt; B_{MSY}: 92,000 mt, MSY: 6,300 mt, F_{MSY}: 0.06). The two-line model has a lower S-R trajectory and indicates that the stock has rebuilt (B_{2009}: 14,000 mt, B_{MSY}: 3,000 mt, MSY: 2,500 mt, F_{MSY}: 0.16).

It is not known which of the two recruitment scenarios is more plausible, *i.e.*, one model assumes that conditions have not changed (B-H) and the stock has not recovered, while the other (two-line) indicates that there has been a regime shift to a lower level of productivity and the stock has fully recovered. There is no direct evidence to support either model. For the COSEWIC evaluation, the biomass decline is the main concern, regardless of which S-R is used. Thus it is noteworthy that projections using the current TAC of 1,750 mt show an increase in population biomass for both S-R relationships.

Population recovery targets should be specific, measurable, achievable and time-bound. It was suggested that intermediate targets could be considered in this process, not just B_{MSY}, which is complicated by the two recruitment scenarios. An example of an intermediate target would involve increasing the current biomass level by X% over a certain time period. Consideration could also be given to rebuilding targets used by other nations which fish the western Atlantic stock, which in most cases is MSY. The group concluded that B_{MSY} could be used as well as intermediate targets. Given that B_{MSY} from the Beverton-Holt S-R model is estimated at 92,000 mt, and the maximum observed SSB in the time series is about 50,000 mt, it appears that the B-H estimate for SSB is outside the range of observations and therefore, the high recruitment scenario is the less plausible of the two models. After considerable discussion, the final proposed recovery target for abundance reported in the SAR was to increase spawning stock biomass compared to 2012.

It was suggested that the Canadian CPUE indices for large Atlantic bluefin tuna could be a useful indicator for the Canadian portion of western Atlantic bluefin habitat but that there are caveats associated with CPUE as an indicator. Variability in prey abundance and changes in environmental conditions can greatly influence the availability of Atlantic bluefin tuna to the Canadian fishery, so these aspects also need to be evaluated. Industry reported that they are seeing an increase in abundance across the entire fishery, in southwestern Nova Scotia and the southern Gulf of St. Lawrence. There appears to be more fish each year over the past few

years and steaming time to fishing grounds has been reduced since Atlantic bluefin tuna aggregations are now "closer to home."

The group recognized that the location of the Canadian fishery is influenced by more than fish distribution, and that the distribution will change based on prey availability and oceanographic features. Therefore, the "target" for distribution would be to avoid actions which would prevent Atlantic bluefin tuna from occupying available habitat in Canadian waters resulting in a decrease in distribution, and to maintain as broad a distribution in Canadian waters as possible.

2. ***Project expected Atlantic bluefin tuna population trajectories over three generations (or other biologically reasonable time), and trajectories over time to the recovery target (if possible to achieve), given current Atlantic bluefin tuna population dynamics parameters and associated uncertainties using DFO guidelines on long-term projections (Shelton et al. 2007).***

Fishing at a TAC of 1,750 mt and assuming the low recruitment hypothesis, the population reaches the B_{MSY} target. Under the high recruitment hypothesis the population target cannot be reached. (See also Term of Reference 19 for a discussion of projections.)

Assess the Habitat use of Bluefin Tuna in Atlantic Canadian Waters

3. ***Evaluate residence requirements for the species, if any.***

It was determined that this Term of Reference was not that pertinent to western Atlantic bluefin tuna which has only part of its life history in Canadian waters.

The *Species At Risk Act* defines residence as:

> *"a dwelling-place, such as a den, nest or other similar area or place, that is occupied or habitually occupied by one or more individuals during all or part of their life cycles, including breeding, rearing, staging, wintering, feeding or hibernating".*

As such, the concept of residence does not apply to Atlantic bluefin tuna whilst in Canadian Atlantic waters.

4. ***Provide functional descriptions (as defined in DFO 2007b) of the properties of the aquatic habitat that bluefin tuna needs for successful completion of all life-history stages.***

To date, no specific habitat requirements have been defined for Atlantic bluefin tuna. It is recognized that they can regulate their temperature and therefore tolerate a wide temperature range. Studies have shown a wide range of temperature where Atlantic bluefin can be found as well as the depth they occupy. In other words, they occupy a wide range of latitudes and depths because of their temperature tolerances. In Canada, Atlantic bluefin tuna occur in Canadian waters during a feeding migration (mainly between July and November) and there is no special habitat requirement for spawning or larval rearing in Canadian waters.

There was discussion about the importance of forage fish on the distribution and abundance of Atlantic bluefin tuna. A change in forage fish could see a big change in the abundance of Atlantic bluefin tuna. While there is concern about forage fish in some areas, the areas where high Atlantic bluefin tuna numbers are seen are also areas where the forage species seem to be doing well. It was emphasized that Ecosystem Based Fisheries Management is an important

approach to protect forage species. Though there are no specific habitat requirements in Canadian waters, the importance of forage species was noted.

It was not possible to provide functional descriptions of aquatic habitat for successful completion of all life history stages since Atlantic bluefin tuna do not spawn in Canadian waters. However there is a functional relationship with the largest fish found in the southern Gulf of St. Lawrence and smaller fish found in other areas.

5. ***Provide information on the spatial extent of the areas in bluefin tuna's range in Canada that are likely to have these habitat properties.***

The spatial distribution in Canadian waters varies from year to year and is influenced by factors such as prey availability and oceanic conditions. It was concluded that it is not possible to provide the spatial extent of the Atlantic bluefin tuna's range in Canada.

6. ***Recommend research or analysis activities that are necessary in order to complete these habitat-use Terms of Reference if current information is complete.***

Continuing the existing electronic tagging studies and analyzing their results will contribute to a better understanding of Atlantic bluefin tuna habitat requirements in Canadian waters.

7. ***Identify the activities most likely to threaten the habitat properties that give the sites their value, and provide information on the extent and consequences of these activities.***

Activities were identified which could potentially threaten Atlantic bluefin tuna habitat offshore, including seismic activity and oil and gas exploration. Coastal habitat areas could be impacted by municipal waste (sewage) discharge. At present, there is no information available to quantify the extent and consequences of these activities. Similarly, there is no indication that the quality and quantity of Atlantic bluefin tuna habitat in Canadian waters has been reduced in a way which would limit population growth.

There is renewed interest in conducting oil and gas exploration in the Gulf of St. Lawrence; an application has been submitted which is currently in the panel review process for environmental impact assessment.

The Deep Horizon Oil spill in the Gulf of Mexico was identified as having a negative impact on the 2010 year class (20% reduction) which would result in a 4% reduction of future SSB and could also reduce the quality of spawning habitat (Atlantic Bluefin Tuna Status Review Team 2011).

Overfishing of Atlantic bluefin tuna forage species (*i.e.*, herring and mackerel) in Canadian waters was identified as an activity which could threaten Atlantic bluefin tuna habitat, since prey species abundance/aggregations could be considered as an important proxy for habitat. Research has indicated that the presence of prey in the Gulf of Maine was identified as an important explanatory variable in terms of Atlantic bluefin tuna distribution (*i.e.*, shifts in Atlantic bluefin distribution were associated with shifts in the distribution of prey).

Global warming was also identified as a potential threat to Atlantic bluefin tuna habitat in Canadian waters.

8. ***Quantify to the extent possible the likelihood that the current quantity and quality of habitat is sufficient to allow population increase, and would be sufficient to support a population that has reached its recovery targets.***

There is no evidence to the contrary.

9. ***Assess to the extent possible the magnitude by which current threats to habitats have reduced habitat quantity and quality.***

There is no evidence that habitat has been reduced.

Summary

Fisheries on Atlantic bluefin tuna are managed on the basis of a two stock hypothesis, separated by 45°W, but fish of western origin are caught east of 45°W and *vice versa*. Canadian fisheries harvesting larger size classes are believed to include little contribution from the eastern component, relying essentially on western origin Atlantic bluefin tunas. There is no information suggesting that Atlantic bluefin tuna in Canadian waters should be divided into substocks or subpopulations.

SSB shows an initial steep and steady decline from 1970 to the mid-1980s and relative stability since then; with indications of a possible slight increase in recent years. SSB is estimated to have peaked at 51,500 mt in 1973, declined to 15,000 in 1985 and remained relatively stable since then with the 2009 SSB estimated at 14,000 mt. Total abundance (age 1 and older) estimated in the most recent assessment was at its maximum in 1970 (1.3 million individuals) and the most recent estimate (2009) is slightly above 300,000 individuals. The proposed recovery target for abundance is to increase spawning stock biomass compared to 2012.

Fishing at a TAC of 1,750 mt under the low recruitment hypothesis, the population reaches the B_{MSY} target. Under the high recruitment hypothesis the population target cannot be reached.

In Canadian waters the range of Atlantic bluefin tuna extends from Georges Bank, into the Bay of Fundy, along the Scotian Shelf, in the Gulf of St. Lawrence, to the Grand Banks of Newfoundland and from coastal waters to the boundary of Canada's Exclusive Economic Zone. There is no evidence that range has been reduced. Recognizing that local Atlantic bluefin tuna distribution is ephemeral as it is linked to their prey distribution and oceanographic features, the proposed distribution target for recovery is to maintain habitat conditions allowing for a broad distribution in Canadian waters. As defined by the *SARA*, Atlantic bluefin tuna do not have a residence whilst in Canadian waters.

SOURCES OF HUMAN-INDUCED HARM AND ALLOWABLE HARM

Scope for Management to Facilitate Recovery of Bluefin Tuna in Atlantic Canadian Waters

10. Quantify to the extent possible the magnitude of each major potential source of human-induced mortality identified in the pre-COSEWIC assessment, the COSEWIC Status Report (COSEWIC 2011), information from DFO sectors, and other sources.

COSEWIC (2011) identifies overfishing as the single largest threat to the western population of Atlantic bluefin tuna. Canadian catches and discards by gear for 1980 to 2009 were examined. In Canada the fishery includes commercial harvest (tended line, rod and reel, electric harpoon, and trapnet) and charter boats (rod and reel) as well as a directed harvest by one offshore longline vessel. There are also some incidental catches and mortalities in other fisheries including: pelagic longline fisheries for swordfish, sharks, and other tunas (bigeye tuna, albacore, and yellowfin tuna collectively referred to as other tunas) (approximately 30 to 40 mt per year), as well as in trap, weirs, gillnets, and purse seine fisheries for small pelagics. This incidental catch and associated mortality are presumed to be small. Since 1982, western Atlantic bluefin tuna has had strict catch limits established by ICCAT with the aim of allowing the stock to increase yet the assessment does not show increases to the extent intended. This could be due to increased mortality of western Atlantic bluefin tuna east of 45°W or changes in productivity. Canada has been in compliance with these measures. TACs for 2011 and 2012 have been set such as to allow growth in the stock under both recruitment hypotheses.

It was suggested that a column be added to the table of Canadian landings and discards to show the annual TAC; however, after some discussion this proposal was rejected. While Canada has an annual TAC, there are overharvest and underharvest carry-over provisions, such that the catch might exceed the TAC but still be in compliance with the ICCAT regulatory recommendation. It was felt that the carry-over provisions were too complex to explain in the table and hence the TAC column was not included. It was agreed to note in the SAR text that Canada has been in compliance with the ICCAT measures.

Anthropogenic noise such as seismic activity was identified as an additional potential threat to Atlantic bluefin tuna due to deleterious effects it may have on behaviour and physiology of Atlantic bluefin tuna and its prey (McCauley et al. 2003; Weilgart 2007). Anthropogenic ocean noise is mainly the result of underwater explosions, seismic exploration, naval sonar operations, and shipping. Ongoing seismic noise from oil and gas exploration exists in the Canadian range of Atlantic bluefin tuna. Imminent increases in oil and gas development and seismic testing in the Gulf of St. Lawrence may pose a threat to Atlantic bluefin tuna and their prey.

Considering the Deepwater Horizon oil spill, the potential effects on the future abundance of western Atlantic bluefin tuna was evaluated by comparing the projections made by the ICCAT SCRS (Anon. 2011a) with similar projections that assume the number of yearlings (one-year-old fish) in 2011 will be reduced by 20% (Atlantic Bluefin Tuna Status Review Team 2011). The value of 20% was based on the recent report by the European Space Agency that suggested that about 20% of the spawning habitat was oiled. The Atlantic Bluefin Tuna Status Review Team indicated that the reduction in the 2010 year-class strength will likely result in less than a 4% reduction in future spawning biomass. However, those analyses concluded that if a significant fraction of adult Atlantic bluefin tuna were killed or rendered impotent by the spill, then subsequent year-classes might also be reduced, leading to greater reductions in spawning biomass than estimated above. To date, however, there has been no evidence that any portion of adults were deleteriously affected.

11. Assess the probability that the recovery targets can be achieved under current rates of Atlantic bluefin tuna population dynamics parameters, and how that probability would vary with different mortality (especially lower) and productivity (especially higher) parameters.

The results of ICCAT's 2010 assessment show an initial steep and steady decline in SSB from 1970 to the mid-1980s and relative stability since then; with indications of a possible slight increase in recent years. The proposed recovery target for abundance is to increase spawning stock biomass compared to 2012. Under the low recruitment scenario (two-line model), SSB targets have been achieved and SSB has rebuilt. Under the low recruitment scenario 2025 SSB would be equal to or larger than the 2012 SSB for catches of 2,250 mt or less. Under the high recruitment scenario (B-H model), SSB targets have not been achieved and the stock is not rebuilt. Both scenarios project an increase in SSB at the TAC (1,750 mt) agreed to for 2011 and 2012.

The proposed recovery target for abundance is to increase spawning stock biomass compared to 2012.

The National Marine Fisheries Service (NMFS) of the USA has recently reviewed the status of Atlantic bluefin tuna (Atlantic Bluefin Tuna Status Review Team 2011) and made longer term projections looking at the probability of extinction (where the number of spawners is reduced to less than two fish and reproduction was therefore no longer possible) under various catch scenarios. NMFS forecasted the probability that the western Atlantic bluefin tuna distinct population segment will go extinct by year and catch level, assuming the ICCAT high and low recruitment potential scenarios were equally plausible. The results indicate a low probability of extinction at the total allowable catch (TAC) agreed for 2011 and 2012 (1,750 mt).

Since the 2009 assessment, the USA has found that the 2003 year class is predominant in the catch, supporting the notion that this is a strong year class.

Allowable Harm Assessment

12. Evaluate maximum human-induced mortality which the species can sustain and not jeopardize survival or recovery of the species.

After some discussion, given that the proposed recovery target is an increase in SSB compared to 2012, maximum allowable harm was agreed to be the maximum removals by the fishery that would still result in the SSB in 2025 being greater than the SSB in 2012. Through further discussion the approach for the Allowable Harm section was agreed upon before the close of the meeting, and it was agreed that the probability table would be revised as requested (obtain actual probability matrix from the ICCAT Secretariat; 0 to 3,500 mt catch scenarios; out to 2025; reverse the probabilities) and circulated to participants the following week. That was done, and the revised table and text was distributed by email 20 July 2011 and consensus achieved on 22 July 2011.

Summary

The only documented human induced mortality to Atlantic bluefin tuna in Canadian waters is fishing, both directed and incidental. Potential threats that were identified include oil and gas exploration and exploitation, anthropogenic noise, and global climate change.

The proposed recovery target for abundance is to increase spawning stock biomass compared to 2012. ICCAT medium term projections are provided for various catch scenarios. These suggest that the 2025 SSB would be equal to or larger than the 2012 SSB for catches of 2,250 mt or less.

Given that the proposed recovery target is an increase in SSB compared to 2012, maximum allowable harm was agreed to be the maximum removals by the fishery that would still result in the SSB in 2025 being greater than the SSB in 2012. The probability that SSB in 2025 would be less than the SSB in 2012 with the current TAC (1,750 mt) is 0.04.

POPULATION PROJECTIONS AND RECOVERY TARGETS

13. *Project expected population trajectory (and uncertainties) over three generations (or other biologically reasonable time), and to the time of reaching recovery targets when recovery is feasible; given mortality rates and productivities associated with specific scenarios identified for exploration (as above). Include scenarios which provide as high a probability of survivorship and recovery as possible for biologically realistic parameter values.*

It was decided that all projections should be based on the low recruitment scenario which implies that there has been a regime shift. The RPA should indicate that two options were available but that only one was chosen in the end.

The higher recruitment scenario indicated a higher rate of increase but there was uncertainty about how realistic this was, given that that the model estimate used four very high recruitments from very early on in the time series. In the end, the group decided that this recruitment scenario was not plausible.

All projections were based on the strength of the 2003 year class, which may be overly optimistic. The weights at age were not updated for projections.

Western Atlantic bluefin tuna projection results were examined relative to 2012 under various catch scenarios for the low recruitment hypothesis (from Anon. 2011b). These approximate the following mitigation scenarios: 0 mt - no catch in the western Atlantic; 250 mt - bycatch only by all in the western Atlantic; 1,250 mt - no Canadian catch, others status quo catches in the western Atlantic; 1,500 mt - ½ Canadian catch, others status quo catches in the western Atlantic; 1,750 mt - current western Atlantic total allowable catch; 2,250 mt - 2010 ICCAT scientific advice. F_{MSY} and $F_{0.1}$ projections were also discussed. The main assumption for the catch scenarios was that the Canadian-only reductions in catch would not be allocated to the TAC of other nations (Japan, USA).

Industry commented that Canada could make a difference even though it fishes only a portion of the western Atlantic stock, hence the projection scenarios at 1,250 mt and 1,500 mt.

It was noted that fishing is not the only influence on recovery but also environmental conditions, which affect productivity, as well as global warming.

17. Recommend parameter values for population productivity and starting mortality rates, and where necessary, specialized features of population models that would be required to allow exploration of additional scenarios as part of the assessment of economic, social, and cultural impacts of listing the species.

ICCAT assumes that western origin Atlantic bluefin tuna are mature at 9 years of age. Age at maturity in the eastern stock is estimated to be 4 to 5 years of age. No new information was available to compare growth rates or size at age over time. The natural mortality rate is estimated to be 0.14 and the generation time is estimated to be 15 years. Recent studies documented decreases in the somatic condition of Atlantic bluefin tuna from the late 1990s through 2005 in the Gulf of St Lawrence (it increased in 2006 and has varied slightly though 2007, 2008, and 2009) (Paul et al. 2011) and Gulf of Maine (Golet et al. 2007). The 14-year period of decline in Atlantic bluefin tuna condition observed in the Gulf of Maine was mirrored in large herring size classes (Golet et al. unpublished data; Golet 2010). The reasons for the decline are unknown, but the trend has reversed.

Summary

ICCAT medium term projections were provided for various catch scenarios. These suggest that the 2025 SSB would be equal to or larger than the 2012 SSB for catches of 2,250 mt or less.

MITIGATION AND ALTERNATIVE TO ACTIVITIES

It was clarified and emphasized that the information discussed in this section is not for management decisions, rather to inform the development of potential management scenarios.

18. Using input from all DFO sectors and other sources as appropriate, develop an inventory of all feasible measures to minimize/mitigate the impacts of activities that are threats to the species and its habitat (Steps 12 and 13).

Measures to mitigate the impacts of activities that are threats to Atlantic bluefin tuna and their habitat for the fraction of the stock that occurs in Canadian waters were described. It was noted that a small portion of the Canadian fishery is comprised of immature fish in addition to large mature fish and that the fishery is represented by a wide size range (several year classes) and is not focused on just one size group (year class).

The southern Gulf of St. Lawrence and southwestern Nova Scotia components provide catch rate information used in the assessment of the stock.

Measures are in place to reduce the bycatch of Atlantic bluefin tuna in the Canadian shark fishery.

It was noted that the abundance of forage species in Canadian waters is below where it should be in terms of their productivity. However, forage species issues are better addressed under habitat as opposed to mitigation in the RPA process. An important aspect of Ecosystem Based Fisheries Management is that the Minister can make decisions about forage species to reduce their catch/bycatch in Canadian waters.

It was concluded that feasible mitigation measures to minimize threats include a reduction or elimination of landings of Atlantic bluefin tuna in directed fisheries or as a bycatch in other fisheries. If a significant reduction in harvests is required, measures to achieve this could include:

- reduced or no authorization for a directed harvest of Atlantic bluefin tuna in either a commercial or charter boat fishery;
- mandatory release of any incidentally caught Atlantic bluefin tuna in any fishery (dead or alive) to reduce the incentive to target Atlantic bluefin tuna;
- time and area closures of other directed fisheries (*e.g.*, large pelagic longline, trap, weirs, gillnets or purse seine fisheries for small pelagic fishes) to reduce Atlantic bluefin tuna bycatch;
- gear configuration changes in other directed fisheries to reduce incidental catch (*e.g.*, weak hook swordfish/other tuna longline fishery, changes to reduce the entry of Atlantic bluefin tuna into traps for small pelagics, elimination of the use of kites in the shark recreational fishery);
- change in gear type to reduce incidental take of Atlantic bluefin tuna;
- identification of locations/fisheries where incidental catch of Atlantic bluefin tuna is significant and where seasonal or area closures could reduce impacts on Atlantic bluefin tuna; and
- reduction in overall fishing effort by other gear types associated with Atlantic bluefin tuna bycatch mortality (*e.g.*, pelagic longline fisheries, small pelagic traps, weirs, gillnets or purse seines, *etc.*).

Further, increasing the post-release survival of any Atlantic bluefin tuna released is another feasible mitigation measure to minimize threats. Such measures could include:

- the development and implementation of guidelines to ensure that the release of incidentally caught Atlantic bluefin tuna ensures maximum survival; and
- change in gear types in other fisheries that would facilitate the release of incidentally caught Atlantic bluefin tuna.

19. Using input from all DFO sectors and other sources as appropriate, develop an inventory of all reasonable alternatives to the activities that are threats to the species and its habitat (Steps 12 and 13).

Other fisheries in Atlantic Canada have a bycatch of Atlantic bluefin tuna. Large pelagic fisheries can have notable bycatches of Atlantic bluefin when using longline gear. However the pelagic longline fleet is also permitted to fish with harpoon and trolling gear in addition to their longline gear when directing for swordfish and other tunas. Alternative fishing methods such as rod and reel or tended line could result in increased survivability for released incidentally caught Atlantic bluefin tuna but could affect harvests of these target species.

While for the most part Atlantic bluefin tuna occurring in small pelagic fish traps or weirs can be released alive, other small pelagic directed gear types such as purse seine, gillnet, midwater trawl could have incidental catches that would have a higher mortality rate. If Atlantic bluefin tuna mortality associated with small pelagics fisheries is considered significant, alternative fishing gears or reduced harvesting may be required in small pelagics fisheries.

20. *Using input from all DFO sectors and other sources as appropriate, develop an inventory of activities that could increase the productivity or survivorship parameters (Steps 3 and 15).*

There is no spawning in Canadian waters and habitat does not appear to be limiting. There are currently no activities identified or planned for the purpose of increasing productivity or general survival of Atlantic bluefin tuna in Atlantic Canadian waters. The mitigation measures outlined above to limit impacts on the stock would be consistent with a goal of increasing survivorship in domestic waters.

While the impacts of other human impacts for activities such as seismic exploration are not known, activities that are determined to impact Atlantic bluefin tuna survival could be restricted to periods when Atlantic bluefin tuna is not in Canadian waters.

21. *Estimate, to the extent possible, the reduction in mortality rate expected by each of the mitigation measures in step 15 or alternatives in step 16 and the increase in productivity or survivorship associated with each measure in step 17.*

In recent years, Canada has harvested approximately 500 mt per year, or 28-30% of all of the reported mortalities of western Atlantic bluefin tuna on an annual basis; the majority of other mortality is associated with Japanese and USA fisheries. Total elimination of any directed fishing for western Atlantic bluefin by Canadian fish harvesters could result in an approximate 24% reduction in the overall western Atlantic bluefin tuna mortality from fishing (the 4-6% difference is attributed to by-catch mortality). Based on current assumed mortalities from the Canadian bluefin tuna charter boat fishery, elimination of this catch and release fishery would result in less than a 1% reduction in western Atlantic bluefin tuna mortality.

The mandatory release of any Atlantic bluefin tuna caught incidentally in any fishery in Atlantic would likely result in an additional reduction in overall human induced mortality of 2-3% (based on elimination of 70-100 mt of bycatch in pelagic longline fisheries for swordfish and other tunas or from mackerel traps with an assumed 40-60% survival of released bycatch). Seasonal or area closures combined, change in gear configurations and reduced fishing in other fisheries that harvest Atlantic bluefin tuna incidentally would likely only result in a small reduction in mortality from fishing.

Switching gear types in other fisheries (from pelagic longline to harpoon for swordfish or to fish traps from seines for small pelagics) would be expected to have a small reduction in the overall mortality of western Atlantic bluefin tuna associated with these fisheries.

The point was made that in the SAR, when scenarios are presented, that this assumes that other conditions (both fishing by other nations and environmental) remain unchanged.

Summary

The only documented human induced mortality to Atlantic bluefin tuna in Canadian waters is fishing, both directed and incidental. Feasible mitigation measures to minimize the threat posed from fishing include a reduction or elimination of landings of western Atlantic bluefin tuna in directed fisheries or as a bycatch in other fisheries, and measures to increase the post-release survival of any Atlantic bluefin tuna released as a result of undersized fish harvests or as a mandatory requirement by fleets not authorized to retain Atlantic bluefin tuna. There are other fisheries in Atlantic Canada that may have a bycatch of Atlantic bluefin tuna that have not been identified.

SOURCES OF UNCERTAINTY

The results of this RPA are mainly based on the analysis from the 2010 ICCAT assessment of Atlantic bluefin tuna. Several sources of uncertainty in the ICCAT stock assessment model were noted during discussions. These uncertainties include: the amount of mixing between the eastern and western origin Atlantic bluefin tuna stocks in the western stock; the recruitment scenarios used for the stock assessment; the strength of the 2003 year class and the proportion that will recruit to the spawning population; uncertainties surrounding the assessment scenario based on data going back to the 1960s; and questions around the age of maturity of the fish. Concerns were also expressed in regard to the representative ness of CPUE data as an index of abundance for the species.

The primary source of uncertainty is the amount of mixing between the eastern and western origin Atlantic bluefin tuna. While no or negligible numbers of eastern origin Atlantic bluefin tuna are believed to be present in Canadian waters, western origin Atlantic bluefin tuna are known to be caught east of 45° W in unknown quantities. Conversely, the number of eastern origin Atlantic bluefin tuna in the western Atlantic (particularly of the coast of the USA), is unknown. If the mixing of the eastern and western origin Atlantic bluefin tuna in the western Atlantic is substantial, this violates the assumption that eastern origin fish do not cross the 45° W.

ICCAT (2010b) considers two different possible states of nature for Atlantic bluefin tuna in the western Atlantic. The advice from the ICCAT SCRS is that both of the recruitment scenarios based on these two states are possible. The first scenario, high recruitment, assumes that it is possible for future recruitment to be as large as the numbers observed in the late 1960s to early 1970s. This implies that B_{MSY} is 91,712 mt. The second scenario, low recruitment, suggests that because of unknown changes in the ecosystem, the high recruitment observed in the past is no longer possible. Therefore, future recruitment is estimated from the 1975 to 2005 year classes and B_{MSY} is much lower at 12,722 mt. The inability to reject either scenario leads to uncertainty in setting recovery goals.

The current ICCAT assessment and projections rely heavily on the perceived strength of the 2003 year class. There is evidence from the USA fishery that this year class continues to be strong as it recruits into the fishery. However, there have been strong year classes in the past that have failed to recruit to the spawning population and contribute to increases in biomass as expected.

The age at maturity (9+) used for the assessment of the western Atlantic stock has not been reviewed/updated for several years and may actually be lower now compared to the past. Recent analyses based on new information from endocrine and gonad data suggest that the maturity ogive should be adjusted downwards so that maturity occurs at a younger age. The magnitude of the downward shift in maturity would be another source of uncertainty which could influence the interpretation of stock status and trends.

The distribution of Atlantic bluefin tuna extends over a geographical area that is too large to be covered by fisheries independent surveys. The ICCAT assessments for western Atlantic bluefin tuna use a combination of 11 indices of relative abundance from the commercial fisheries and a larval index from surveys in the Gulf of Mexico which is based on a relatively small number of individual larvae caught per year. Four of the twelve stock size indices provide information on historical abundance but not on recent trends. Trends in the other indices are difficult to discern except for the Canadian indices which show clear increases in recent years, particularly for the

Gulf of St. Lawrence. However, all the indices are fisheries-dependent. Fisheries-independent surveys would help to reduce the uncertainty in the current stock status.

The effects of large scale environmental change on species productivity and habitat suitability are unknown.

Unreported discards of Atlantic bluefin tuna are not considered to be a large source of mortality in Canadian fisheries; however, this remains to be quantified.

RESEARCH RECOMMENDATIONS, MEETING DOCUMENTS AND NEXT STEPS

Research Recommendations

GBYP: Canada, along with other ICCAT partners, has commenced participation in an intensive five year program of scientific research intended to improve the understanding of Atlantic bluefin tuna population dynamics (ICCAT Grande Bluefin Year Program (GBYP)). An important part of the program is to establish an activity to sample the commercial fishery, and determine stock origin. This project is viewed as high priority in light of the sensitivity of the assessment to assumptions concerning mixing and should be encouraged. Canada has made substantial commitment to research in support of the ICCAT GBYP through the International Governance Strategy.

Mixing: It is recommended that the influence of the strong 2003 year class recruiting from the east be monitored and examined in the assessment, and that the extent of the mixing between the eastern and western origin Atlantic bluefin tuna should continue to be quantified and incorporated into stock assessments.

Stock-Recruitment Relationship: Other S-R models and statistical approaches could be explored to help determine which of the two S-R models is more plausible, or if another method is more appropriate (*i.e.*, re-sampling the observed recruitments through the different time periods, *e.g.*, southern Designatable Unit cod).

Environmental Influences: The stock's health is reflected by changes in its range, loss of condition, a reduction in weight at age, a reduction in age at maturity and a change in the age structure of the population. It is recommended that the functional relationship between these indicators and physical oceanographic factors be investigated in order that their impacts can be dissociated from impacts due to fishing.

CPUE: The development of meaningful indices of stock abundance depends on accurate reporting of the effort associated with the catch. It is recommended that the fishermen's logbooks accommodate means of associating the appropriate effort and gear type with the catch and that these associations are reflected in the database. The accuracy of the observer data in relation to discard estimates over all fisheries that catch Atlantic bluefin tuna should be evaluated, including fisheries that could have incidental captures of Atlantic bluefin tuna but do not currently have observer coverage. It was further recommended that the history of management changes be reviewed and documented to determine if the changes need to be incorporated into the CPUE standardization.

Age at Maturity: Review the size and age at maturity to determine if it has changed from that assumed in the ICCAT assessment (western Atlantic bluefin tuna, 9+). Unpublished work

indicates that fish in the Gulf of Maine may be sexually mature at smaller sizes, and that there is a greater range in the age at maturity.

Fisheries-Independent Research: Investigate options for fisheries-independent methods/surveys and estimates of abundance to be used in the ICCAT assessments. Continue to collect and analyse electronic tagging data for fishery independent distribution/habitat information; maps could be constructed to inform habitat use based on known fish location.

Other Threats: The COSEWIC status report listed fishing as the main threat to Atlantic bluefin tuna. Other threats from seismic exploration and oil and gas development have not been investigated or quantified.

Meeting Documents and Next Steps

There will be a Science Advisory Report and one Research Document resulting from this meeting in addition to the Proceedings.

To give context to the RPA process - scientific information (the RPA) is needed to support the next steps: development and assessment of social and economic cost and benefits of potential management scenarios for recovery to better inform public consultations and to support other entities involved in the decision of whether to add the species to Schedule 1 of the *Species at Risk Act* (*SARA*). If it is legally listed, the information in the RPA will be used to develop a recovery strategy.

ADJOURNMENT

At the conclusion of the meeting there was consensus on the draft Science Advisory Report including the Summary Bullets. The approach for the Allowable Harm section was agreed upon before the close of the meeting, and it was agreed that the probability table would be revised as requested (obtain actual probability matrix from the ICCAT Secretariat; 0 to 3,500 mt catch scenarios; out to 2025; reverse the probabilities) and circulated to participants the following week. The Co-Chairs advised that the draft SAR would be circulated for information when the edits were complete.

The Co-Chairs thanked the participants for an extremely productive meeting, noting a broad suite of expertise and affiliation in the group. It was an excellent example of Science, Fisheries Management, Species at Risk, Policy & Economics and stakeholders working together. The Co-Chairs especially thanked the presenters, the reviewers and the rapporteurs. Participants thanked the Chairs for their leadership, and also thanked the hosts for their hospitality including lunches (provided by DFO), home-baking at breaks (provided by individuals), and an informal reception on Thursday evening.

The meeting adjourned at 1:00 PM 15 July 2011.

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APPENDIX 1: Agenda

Atlantic Bluefin Tuna (*Thunnus thynnus*) Recovery Potential Assessment
Maritimes Region Science Advisory Process

Hachey Boardroom, St. Andrews Biological Station, NB
Chairs: Julie Porter and Lei Harris

13-15 July 2011

AGENDA

July 13 2011 – Wednesday

9:00 – 9:15	Welcome and introductions (chair)
9:15 –10:15	Presentation on bluefin tuna ecology, habitat, status, and trends in Atlantic Canadian waters
10:15 – 10:30	Break
10:30 – 12:00	Discussion
12:00 – 13:00	Lunch (provided)
13:00 – 14:00	Presentation on sources of human-induced harm and allowable harm
14:00 – 15:00	Discussion
15:00 – 15:15	Break
15:15 – 16:15	Population projections and recovery targets
16:15 – 17:00	Discussion

July 14 2011 – Thursday

9:00 – 10:30	Presentation on mitigation and alternatives to activities
10:30 – 10:45	Break
10:45 – 11:00	Discussion
11:00 – 12:00	Research recommendations, meeting documents & next steps
12:00 – 13:00	Lunch (provided)
13:00 – 17:00	Review of draft of Science Advisory Report
18:00 – 20:00	Informal reception at the home of J. Neilson

July 15 2011 – Friday

9:00 – 13:00	Completion of Science Advisory Report
13:00	Adjournment

APPENDIX 2: Terms of Reference

Terms of Reference

Zonal Advisory Process

Atlantic Bluefin Tuna (*Thunnus thynnus*) Recovery Potential Assessment

13-15 July, 2011
St. Andrews, New Brunswick

Chairpersons: Julie Porter and Lei Harris

Context

When the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designates aquatic species as threatened or endangered, Fisheries and Oceans Canada (DFO), as the responsible jurisdiction under the *Species at Risk Act* (*SARA*), is required to undertake a number of actions. Many of these actions require scientific information on the current status of the species, population or designable unit (DU), threats to its survival and recovery, and the feasibility of its recovery. Formulation of this scientific advice has typically been developed through a Recovery Potential Assessment (RPA) that is conducted shortly after the COSEWIC assessment. This timing allows for the consideration of peer-reviewed scientific analyses into SARA processes including recovery planning.

In support of listing recommendations for Atlantic bluefin tuna by the Minister, DFO Science has been asked to undertake an RPA, based on the National Frameworks (DFO 2007a and b). The advice in the RPA may be used to inform both scientific and socio-economic elements of the listing decision, as well as development of a recovery strategy and action plan, and to support decision-making with regards to the issuance of permits, agreements and related conditions, as per section 73, 74, 75, 77 and 78 of *SARA*. The advice generated via this process will also update and/or consolidate any existing advice regarding Atlantic bluefin tuna (*Thunnus thynnus*).

Objectives

- To assess the current status of the *[species/population/DU]*.
- To the extent possible with the information available, and taking account of uncertainties:

<u>Assess Species Status and Trends in Atlantic Canadian Waters</u>

1. Evaluate present bluefin tuna status for abundance and range and number of populations.

2. Evaluate recent species trajectory for abundance (*i.e.*, numbers and biomass focusing on matures) and range and number of populations.

3. Estimate, to the extent that information allows, the current or recent life-history parameters for Atlantic bluefin tuna (total mortality, natural mortality, fecundity, maturity, recruitment, *etc.*) or reasonable surrogates; and associated uncertainties for all parameters.

4. Estimate expected population and distribution targets for recovery, according to DFO guidelines (DFO 2005).

5. Project expected Atlantic bluefin tuna population trajectories over three generations (or other biologically reasonable time), and trajectories over time to the recovery target (if possible to achieve), given current Atlantic bluefin tuna population dynamics parameters and associated uncertainties using DFO guidelines on long-term projections (Shelton et al. 2007).

Assess the Habitat Use of Bluefin Tuna in Atlantic Canadian Waters

6. Evaluate residence requirements for the species, if any.

7. Provide functional descriptions (as defined in DFO 2007b) of the properties of the aquatic habitat that bluefin tuna needs for successful completion of all life-history stages.

8. Provide information on the spatial extent of the areas in bluefin tuna's range in Canada that are likely to have these habitat properties.

9. Recommend research or analysis activities that are necessary in order to complete these habitat-use Terms of Reference if current information is complete.

10. Identify the activities most likely to threaten the habitat properties that give the sites their value, and provide information on the extent and consequences of these activities.

11. Quantify to the extent possible the likelihood that the current quantity and quality of habitat is sufficient to allow population increase, and would be sufficient to support a population that has reached its recovery targets.

12. Assess to the extent possible the magnitude by which current threats to habitats have reduced habitat quantity and quality.

Scope for Management to Facilitate Recovery of Bluefin Tuna in Atlantic Canadian Waters

13. Quantify to the extent possible the magnitude of each major potential source of human-induced mortality identified in the pre-COSEWIC assessment, the COSEWIC Status Report (COSEWIC 2011), information from DFO sectors, and other sources.

14. Assess the probability that the recovery targets can be achieved under current rates of Atlantic bluefin tuna population dynamics parameters, and how that probability would vary with different mortality (especially lower) and productivity (especially higher) parameters.

Scenarios for Mitigation and Alternative to Activities

15. Using input from all DFO sectors and other sources as appropriate, develop an inventory of all feasible measures to minimize/mitigate the impacts of activities that are threats to the species and its habitat (Steps 12 and 13).

16. Using input from all DFO sectors and other sources as appropriate, develop an inventory of all reasonable alternatives to the activities that are threats to the species and its habitat (Steps 12 and 13).

17. Using input from all DFO sectors and other sources as appropriate, develop an inventory of activities that could increase the productivity or survivorship parameters (Steps 3 and 15).

18. Estimate, to the extent possible, the reduction in mortality rate expected by each of the mitigation measures in step 15 or alternatives in step 16 and the increase in productivity or survivorship associated with each measure in step 17.

19. Project expected population trajectory (and uncertainties) over three generations (or other biologically reasonable time), and to the time of reaching recovery targets when recovery is feasible; given mortality rates and productivities associated with specific scenarios identified for exploration (as above). Include scenarios which provide as high a probability of survivorship and recovery as possible for biologically realistic parameter values.

20. Recommend parameter values for population productivity and starting mortality rates, and where necessary, specialized features of population models that would be required to allow exploration of additional scenarios as part of the assessment of economic, social, and cultural impacts of listing the species.

Allowable Harm Assessment

21. Evaluate maximum human-induced mortality which the species can sustain and not jeopardize survival or recovery of the species.

Expected Publications
- CSAS Science Advisory Reports
- CSAS Proceedings of meeting
- CSAS Research Document(s)

Participation
DFO Science, Ecosystems and Fisheries Management, Oceans, Habitat and Species at Risk, Policy and Economics, Aboriginal Communities, Parks Canada, Provinces, External Reviewers, Industry, Non-governmental organizations and Other Stakeholders will be invited to participate in this meeting.

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APPENDIX 3: List of Participants

Name	Affiliation
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Dunn, Dave	North Shore MicMac District Council
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Elsworth, Sam	Southwest Nova Tuna Association
Fraser, Doug	ICCAT Commissioner
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Hanke, Alex	DFO Maritimes, Science, St. Andrews Biological Station
Harris, Lei	Co-Chair and DFO Maritimes, Science, St. Andrews Biological Station
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Lemieux, Stephanie	DFO Gulf , Policy & Economics
Lester, Brian	DFO Ottawa, Fisheries Management
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